

**FOSSIL ECHINOIDS DEPOSITED IN THE MUSEUM OF SETO MARINE
BIOLOGICAL LABORATORY, SIRAHAMA, WAKAYAMA PREFECTURE
(ON SOME FOSSIL ECHINOIDS OF JAPAN, III)¹⁾**

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With 1 Plate, 3 Text-figures and 1 Table

Introduction and Acknowledgement

Several species of fossil echinoids from Wakayama Prefecture have been reported in various publications, and there are some specimens of fossil echinoids in the museum of Seto Marine Biological Laboratory (Kyoto University) at Sirahama, Wakayama Prefecture. The author had an opportunity to observe these specimens when he called on the Seto Marine Biological Laboratory, and he was recommended to describe them by Professor H. UTINOMI of the Laboratory.

They are *Balanocidaris* sp. of the late Jurassic Period, *Enallaster yuasensis* TANAKA and ÔKUBO and *Enallaster* sp., of the early Cretaceous Period, and *Echinoneus cyclostomus* LESKE of the middle Miocene Epoch, respectively.

The author wishes to acknowledge his indebtedness to Professor Huzio UTINOMI and other members of the Seto Marine Biological Laboratory for their kind permission to examine the specimens.

Fossil Echinoids from Wakayama Prefecture with Geological Note

As far as known at present, species, ages and localities, of fossil echinoids from Wakayama Prefecture, are as the Table 1.

Cretaceous species had been described by K. TANAKA and M. ÔKUBO (1954) and Tertiary species, inserted by the author (1960) in the check list of the Japanese Tertiary echinoids. One of the Tertiary species, *Brissopsis makiyamai* MORISHITA had also been described by him, but another species, *Echinoneus cyclostomus* LESKE, introduced by H. UTINOMI (1954) at first without description.

1) Contributions from the Seto Marine Biological Laboratory, No. 423.

Table 1. A List of Fossil Echinoids hitherto recorded from Wakayama Prefecture.

Species	Age	Locality
<i>Balanocidaris</i> sp.	Jurassic	Monzen, Yura-cho, Hidaka-gun.
<i>Washitaster barremicus</i> TANAKA & ÔKUBO	Cretaceous	Southwest of Yoshikawa, Yuasa-cho, Arita-gun.
<i>Washitaster macroholcus</i> NISIYAMA	Cretaceous	Southeast and Southwest, of Yoshikawa, Yuasa-cho, Arita-gun.
<i>Enallaster</i> cf. <i>obliquatus</i> CLARK	Cretaceous	East of Suhara, Yuasa-cho, Arita-gun.
<i>Enallaster yuasensis</i> TANAKA & ÔKUBO	Cretaceous	Southeast of Yoshikawa and East of Suhara, Yuasa-cho, Arita-gun.
<i>Enallaster</i> cf. <i>böhmi</i> LORIOI	Cretaceous	East of Suhara, Yuasa-cho, Arita-gun.
<i>Enallaster</i> cf. <i>nexilis</i> (NISIYAMA)	Cretaceous	Southeast of Yoshikawa, Yuasa-cho, Arita-gun.
<i>Micraster</i> sp.	Cretaceous	Toyajô-mura ?, Arita-gun.
<i>Astriclypeus manni</i> VERRILL	Miocene	Shirahama-cho, Nishi-Muro-gun.
<i>Echinoneus cyclostomus</i> LESKE	Miocene	Ezura, Shirahama-cho, Nishi-Muro-gun.
<i>Brissopsis makiyamai</i> MORISHITA	Miocene	Tanabe City.

Astriclypeus had been reported as one of several fossils from the Kanayama series by T. TAKEYAMA, but it seems to be somewhat doubtful.

Besides, *Schizaster*? sp. is known from the Miyai series (Miocene) of Kitayama-mura, and an uncertain species of fossil echinoid, from the Kumano group (Miocene) of Nachi-Katsuura-cho in Wakayama Prefecture.

In this paper, *Balanocidaris* sp. is added newly in the above list.

The Torinosu formation (late Jurassic) distributes around the locality *Balanocidaris* sp. occurs. According to K. TATEBAYASHI, the Torinosu formation is divided into five members and the lowest, called the Mizukoshi member. Again, the Mizukoshi member intercalates three limestones, and the uppermost one of them is called "Cidaris zone", so this limestone seems to be the geological horizon of *Balanocidaris*.

According to TANAKA and ÔKUBO (1954), *Enallaster yuasensis* occurred from the Arita formation (Barremian: lower Cretaceous) at three points in the south between Suhara and Yoshikawa, of Yuasa-cho, Arita-gun. It is, however, presumed that *Enallaster yuasensis* of this paper occurred from the silty fine-grained sandstone of Toyajô formation (lower stage of Hetonian), judging from the geological map "Todorogi" by K. HIRAYAMA and K. TANAKA.

TANAKA and ÔKUBO (1954) reported *Washitaster barremicus*, *Washitaster macroholcus*, *Enallaster* cf. *obliquatus*, *Enallaster yuasensis*, *Enallaster* cf. *böhmi* and *Enallaster* cf. *nexilis* nearly from Yoshikawa. All of them indicate "Barremian". *Enallaster* sp. of this paper occurred from Yoshikawa too, and the matrix of it seems to be sandstone of the northern facies of Arita formation, judging from the geological map "Kainan" by K. HIRAYAMA and K. TANAKA.

Echinoneus cyclostomus occurred from the upper part of Kanayama series (middle Miocene) and it is only a specimen of fossil *Echinoneus* in Japan.

Discription of Species

Subclass REGULARIA LATREILLE

Order Cidaroidea DUNCAN

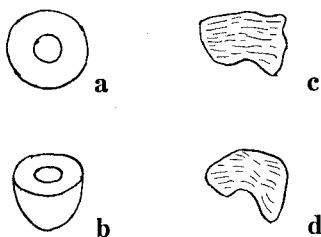
Family Cidaridae GRAY

Genus *Balanocidaris* LAMBERT

Balanocidaris sp.

(Pl. XIV, Figs. 1-2)

All specimens are imperfect primary spines. The surface of them looks closely like to a skin of elephant. They are very thick and grandiform with rather coarse spinules.



Text-Fig. 1. Primary spine of *Balanocidaris* sp.

a : Transverse section. b : Profile.
c, d : Lateral surface like a skin of elephant.

	Transverse diameter.	Inner diameter.
Specimen I :	15.8 mm	7.4 mm
Specimen II :	14.0 mm	5.4 mm
Specimen III :	13.0 mm	5.7 mm
Specimen IV :	12.4 mm	4.8 mm

Geological horizon.—Torinosu formation (late Jurassic).

Locality.—Monzen, Yura-cho, Hidaka-gun, Wakayama Prefecture.

Matrix.—Limestone.

Collector.—Noda.

Subclass IRREGULARIA LATREILLE

Order Spatangoida L. AGASSIZ

Suborder Amphisternata (LOVÉN)

Family Toxasteridae LAMBERT

Genus *Enallaster* D'ORBIGNY

Enallaster yuasensis TANAKA and ÔKUBO

(Pl. XIV, Fig. 3)

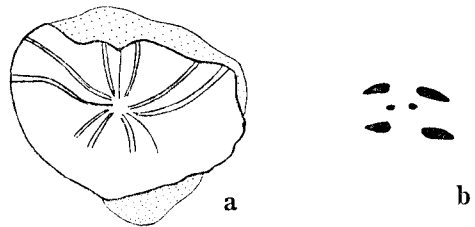
1954 *Enallaster yuasensis* TANAKA AND ÔKUBO. K. TANAKA and M. ÔKUBO, On Some Echinoids from the Paleo-Cretaceous of the Yuasa District in the Kii Peninsula and of the Yatsushiro District in Kyushu, Jour. Geol. Soc. Japan, 60(705), p. 223, pl. 7, fig. 6

The test is cordiform and somewhat heart-shaped in outline. The frontal depression is not remarkable, but rather vaguely recognized.

The odd anterior ambulacrum is depressed in a shallow groove. Its poriferous zones consist of pairs of, round and slit-like pores.

All the paired ambulacra are subpetaloid. The anterior paired ambulacra are flexous, namely curve anteriorly close to the centre and turn posteriorly at the extremities. Its poriferous zones are narrower in the anterior side than in the posterior side. The pores of poriferous zones in the anterior paired ambulacra are round in the anterior side, and slit-like in the posterior side.

The posterior paired ambulacra are shorter than the anterior paired ones, and curve posteriorly. Its poriferous zones are narrower in the anterior side than in the posterior. The shape and size, of pores of poriferous zones in the posterior paired ambulacra are like very much to those of the anterior paired ones. The peristome and periproct are indistinct.



Text-Fig. 2. *Enallaster yuasensis* TANAKA and ÔKUBO

a : Aboral side. b : Ambulacral pores in odd anterior ambulacra.

Length of the odd anterior ambulacrum:	25.3 mm
Width of the odd anterior ambulacrum:	5.2 mm
Length of the anterior paired ambulacra:	28.7 mm
Width of the anterior paired ambulacra:	5.0 mm
Length of the posterior paired ambulacra:	13.0 mm
Width of the posterior paired ambulacra:	4.1 mm
Angle between Amb. II and IV:	100°
Angle between Amb. II (or IV) and III:	45°
Angle between Amb. I and II (or IV and V):	90°
Angle between Amb. I and V:	100°

Geological horizon.—Toyajō formation (late Cretaceous).

Locality.—Tokuda, Yuasa-cho, Arita-gun, Wakayama Prefecture.

Matrix.—Silty fine-grained sandstone.

Collector.—Seto.

Enallaster sp.

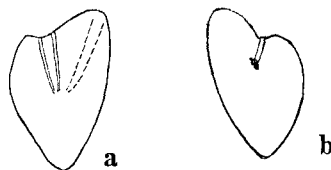
(Pl. XIV, Figs. 4-5)

Three specimens (*a*, *b*, *c*) of *Enallaster*, sp. are being preserved in the museum. They are more or less deformed, or damaged. So the identification of species is impossible. In the specimen *a*, an extremity of the interambulacrum II protrudes, and the interambulacrum III is depressed. The ambulacra are indistinct except the ambulacrum III. The pores are uncertain, but the position of peristome is distinct, situated near the frontal margin of the oral side.

In the specimen *b*, only a frontal half of test preserves: the ambulacra II, III and IV. The oral side is indistinct.

In the specimen *c*, the greater part of aboral side is preserved, but the oral side is indistinct.

The above three specimens are very much like *Enallaster* cf. *nexilis* (NISIYAMA), principally in shape, although several characters of them are obscure in detail.



Text-Fig. 3. *Enallaster* sp.
a : Aboral side. b : Oral side.

	Length	Width	Height
Specimen <i>a</i> :	31.6 mm	27.3 mm	12.0 mm
Specimen <i>b</i> :	?	30.3 mm	?
Specimen <i>c</i> :	37.0 mm	30.0 mm	?

Geological horizon.—Arita formation (early Cretaceous).

Locality.—Yoshikawa, Yuasa-cho, Arita-gun, Wakayama Prefecture.

Matrix.—Medium sandstone.

Collector.—Noda.

Order Holoctypoida DUNCAN
Suborder Echinoneina HAWKINS
Family Echinoneidae WRIGHT
Genus *Echinoneus* LESKE
Echinoneus cyclostomus LESKE

(Pl. XIV, Figs. 6–8)

- 1900 *Echinoneus cyclostomus* LESKE. S. YOSHIWARA, Japanese Echinoids, Zool. Mag., 12, pp. 394–395
- 1907 *Echinoneus cyclostomus* LESKE. S. YOSHIWARA, op. cit., 19, pl. 17, figs. 1–2
- 1925 *Echinoneus cyclostomus* LESKE. H. L. CLARK, Cat. Rec. Sea-urchins, Brit. Mus., p. 177
- 1925 *Echinoneus cyclostomus* LESKE. H. L. CLARK, Echinoderms other than Sea Stars of the Tropical Central Pacific, Bernice P. Bishop Museum, Bull., 27, p. 100
- 1926 *Echinoneus cyclostomus* LESKE. H. L. CLARK, Notes on a Collection of Echinoderms from the Australian Museum, Rec. Austral. Mus., XV, p. 191
- 1948 *Echinoneus cyclostomus* LESKE. I. HAYASAKA, Notes on the Echinoids of Taiwan, Bull. Ocean. Inst., Taiwan, 4, p. 26, pl. 6, fig. 2
- 1948 *Echinoneus cyclostomus* LESKE. Th. MORTENSEN, A Monograph of Echinoidea, IV, *Holoctypoida*, *Cassiduloida*, p. 75, pl. 1: figs. 14, 26, pl. 12: figs. 21, 23
- 1953 *Echinoneus cyclostomus* LESKE. T. TOKIOKA, Invertebrate Fauna of the Intertidal Zone of the Tokara Islands, V. Echinodermata, Publ. Seto Mar. Biol. Lab., 3(2), p. 146
- 1954 *Echinoneus cyclostomus* LESKE. H. UTINOMI, A Check List of Echinoids found in the Kii Region, Publ. Seto Mar. Biol. Lab., 3(3), p. 351
- 1960 *Echinoneus cyclostomus* LESKE. A. MORISHITA, Biostratigraphical Studies of Japanese Tertiary Echinoids, Jour. Earth Sci., Nagoya Univ., 8(1), p. 55

The test is moderate in size and ovoid in shape. All the ambulacra are narrow and not invariably petaloid aborally. Each ambulacrum is the largest in width at the margin of test and tending to be narrower towards the oral side. The pore-zones of ambulacra are very narrow, slightly sunken and straight. The apical system is slightly anterior, and the posterior paired ambulacra are longer than the anterior paired ones. The genital pores are 4, lacking the posterior one. As the oral side is damaged, the peristome and periproct are indistinct.

The tubercles are imperforate or perforate, numerous, and not arranged in vertical series.

Length of test:	35 mm
Width of test:	27.7 mm
Height of test:	14.1 mm

Width of Amb. I: 4 mm
 Width of Amb. II: 4 mm
 Width of interporiferous zone in Amb. I: 2.9 mm
 Width of interporiferous zone in Amb. II: 3.0 mm

Geological horizon.—Kanayama series (middle Miocene).

Locality.—Ezura, Shirahama-cho, Nishi-Muro-gun, Wakayama Prefecture.

Collector.—T. TOKIOKA.

Deposited in the Seto Marine Biological Laboratory (No. R 157).

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EXPLANATION OF PLATE XIV

Balanocidaris sp.

Fig. 1. Primary spines. Transverse section. $\times 1$.

Fig. 2. Primary spines. Profile. $\times 1$.

Enallaster yuasensis TANAKA and ÔKUBO

Fig. 3. Aboral side. $\times 1$.

Enallaster sp.

Fig. 4. Aboral side. $\times 1$.

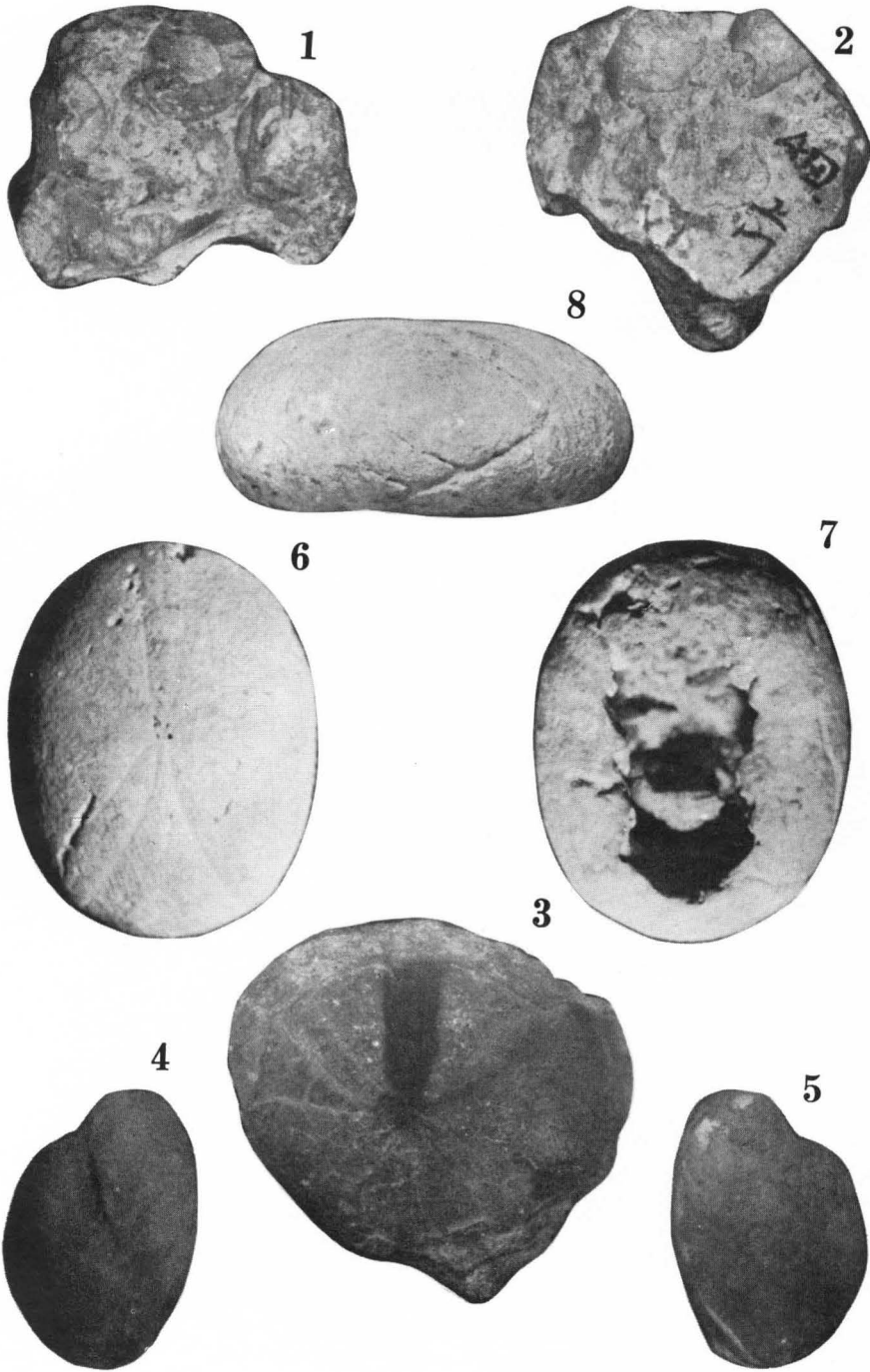
Fig. 5. Oral side. $\times 1$.

Echinoneus cyclostomus LESKE

Fig. 6. Aboral side. $\times 3/2$.

Fig. 7. Oral side. $\times 3/2$.

Fig. 8. Lateral side. $\times 3/2$.



A. MORISHITA: FOSSIL ECHINOIDS.